Influence of surface longwave emissivity and ice clouds longwave scattering on climate simulations

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In reality, surface longwave (LW) emissivity varies with wavelength and surface types, and ice clouds can scatter LW photons. These features, however, are usually ignored in general circulation models, which assume the surface as blackbody and non-scattering ice clouds in LW region, thus suggesting a need to quantify the climate simulation errors related to these assumptions.

In this study we incorporate the surface LW emissivity and ice clouds LW scattering effects into the NCAR CESM, namely, (1) a global surface LW emissivity dataset [1]; (2) an updated LW radiation scheme, RRTMG_LW, with a two-stream solver; (3) a state-of-the-art ice optical parameterization [2]. Both the modified and standard CESM are carried out 10-year simulations with prescribed sea surface temperatures. By comparing these two simulated results, we intend to quantify the influence of the surface emissivity along with ice clouds LW scattering on climate variables such as radiative energy budget and surface temperature. We also put a particular focus on the polar regions, where is a hot spot of human-induced climate changes and previous studies suggest that both surface emissivity and ice clouds LW scattering can play a role in energy budget in these regions [3].

References

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